USDA Natural Resources
Conservation Service

Ecological site R066XY040NE
Shallow Limy

Last updated: 11/18/2024
Accessed: 05/13/2025

General information

Approved. An approved ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model, enough information to identify the ecological site, and full documentation for all ecosystem states contained in the state and transition model.

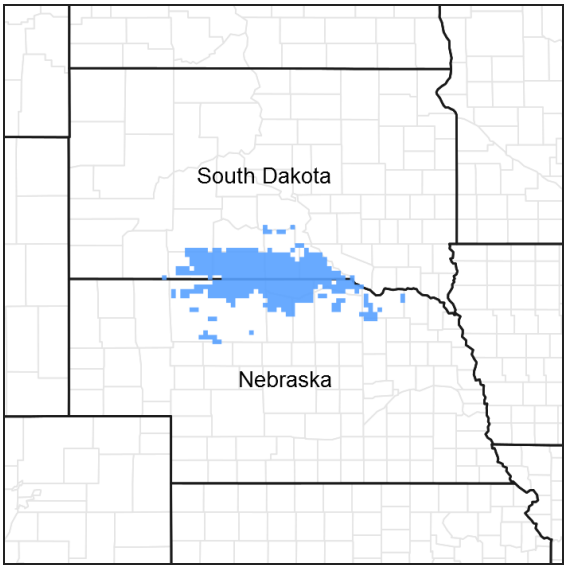


Figure 1. Mapped extent

Areas shown in blue indicate the maximum mapped extent of this ecological site. Other ecological sites likely occur within the highlighted areas. It is also possible for this ecological site to occur outside of highlighted areas if detailed soil survey has not been completed or recently updated.

MLRA notes

Major Land Resource Area (MLRA): 066X–Dakota-Nebraska Eroded Tableland

The Dakota-Nebraska Eroded Tableland (MLRA 66) occurs in north-central Nebraska (56 percent) and south-central South Dakota (44 percent). MLRA 66 is approximately 3.6 million acres and covers all or parts of twelve counties between the two states. The northern border of the MRLA bisects Tripp County, South Dakota, just south of the town of Winner. Valentine is in the northeastern corner of Cherry County, Nebraska and is located on the MLRA's southwestern border. From there, the MLRA stretches southeast to the northwestern corner of Antelope County, Nebraska and the town of O'Neil, Nebraska in Holt County its southeastern border.

The MLRA occupies a smooth fluvial plain primarily consisting of broad intervalley areas with terraces, river breaks, and local badlands along the well-defined major drainages. The slopes range from nearly level tablelands to steep ridges and drainages. The elevation ranges from 1,970 to 2,950 feet. The Keya Paha, Elkhorn, and the Niobrara Rivers flow through the MLRA. The Niobrara is a designated National Scenic River.

Layers of shaly chalk and limestone marine sediments overlaying the Cretaceous Niobrara Formation make up the bulk of the MLRA, though the western and southwestern portions exhibit surface eolian deposits. The floors of the major drainages are underlain by deposits of alluvial sand and gravel. The dominant soil orders in this MLRA are mesic, ustic or aridic Mollisols and Entisols. Loamy and sandy are the primary soil textures in this landscape.

Twenty-seven percent of the land in this MLRA has been broken out of native prairie and farmed, while sixty-six percent of the grasslands remain intact. The remaining acres are divided between forest, urban development, and other uses. Livestock grazing, primarily by cattle, is a major industry. Corn, winter wheat, and grain sorghum are the primary commodity crops but a significant number of acres are planted to forage sorghum and alfalfa for harvest as hay. With limited irrigation available, and annual precipitation averaging from 18 inches in the west to 25 inches in the east, crop production is marginal across most of the MLRA.

The historical matrix vegetation type is mixed-grass prairie. Big bluestem, sand bluestem, prairie sandreed, little bluestem, sideoats grama, and blue grama make up the bulk of the warm-season species. Western wheatgrass, green needlegrass, and needle and thread are the dominant cool-season grasses. Large- and small-patch vegetative communities are found primarily along the riparian zones, on lowland sites, and in closed depressions. Woodlands make up about 3 percent of MLRA 66 and consist primarily of green ash, bur oak, and hackberry. Ponderosa pines can be found on steeper sites in the western portion of the landscape.

Wildlife flourishes in this combination of crop and grassland environments. In a landscape historically occupied by bison herds, white-tailed and mule deer are now the most abundant wild ungulates. Pronghorns also number among the remaining native grazers. A variety of smaller species, including coyote, raccoon, opossum, porcupines, muskrat, beaver, squirrel, prairie dogs, and mink, thrive in the region. Grassland birds, including several upland game birds, are common across the MLRA.

This landscape serves as a backdrop for a disturbance-driven ecosystem, evolving under the influences of herbivory, fire, and variable climate. Historically, these processes created a heterogeneous mosaic of plant communities and structure heights across the region. Any given site in this landscape burned every six to ten years, with most of the MLRA experiencing a six to eight year fire regime. The fires were caused by lightning strikes and were also set by Native Americans, who used fire for warfare, signaling, and to refresh the native grasses. Indigenous inhabitants understood the value of fire as a tool, and that the highly palatable growth following a fire provided excellent forage for their horses and attracted grazing game animals such as bison and elk.

Land use patterns by post-European settlers have greatly altered the historical fire regime, allowing the expansion of woody species. Fragmentation of the native grasslands by conversion to cropland, transportation corridors, and other developments has contributed to disruption of the natural fire regime of this ecosystem. The most common encroaching woody species is eastern redcedar. While eastern redcedar is native to the landscape, the historic population in MLRA 66 was limited to isolated pockets in rugged river drainageways that were protected from wildfire. Widespread plantings of windbreaks with eastern redcedar as a primary component provide a seed source for the aggressive woody plant which further facilitates woody encroachment. Encroachment of native and introduced shrubs and trees into the native grasslands degrades wildlife habit and causes significant forage loss for domestic livestock. Aggressive fire suppression policies have exacerbated this process to the point that shrub and tree encroachment is a major ecological threat to grasslands throughout most of the MLRA.

Classification relationships

►EPA◄
Level IV Ecoregions of the Conterminous United States
43—Northwestern Great Plains:
43i—Keya Paha Tablelands.

►USDA◄
Land Resource Regions and Major Land Resource Areas (USDA-NRCS, 2006)
Land Resource Region: G—Western Great Plains Range and Irrigated Region:
Major Land Resource Area (MLRA): 66 Dakota-Nebraska Eroded Tableland.

Ecological site concept

The Shallow Limy ecological site is located on the breaks and sidehills of the uplands. Soils range from very shallow to shallow with bedrock within 20 inches of the soil surface. Typically, the soils on this site are calcareous within the top 10 inches of the soil profile, although some are not. Slopes are typically less than 15 percent but may be as high as 70 percent.

The vegetation in the Reference Plant Community (1.1) is dominated by a mixture of warm-season tall- and midgrasses. Dominant grasses include little bluestem, sideoats grama, sand bluestem, and big bluestem. Needle and thread, porcupinegrass, western wheatgrass, and blue grama as grasses of secondary importance. Forbs are common and diverse.

Shallow Limy ecological sites are generally not suited to cultivation due to the shallow nature of the soils associated with this site. As a result, most of the Shallow Limy ecological site remains intact as grassland.

Associated sites

R066XY032NE	**Sandy 18-22" P.Z.** Sandy 18-22 PZ ecological sites may be found adjacent to but typically on a lower landscape position than Shallow Limy ecological sites.
R066XY036NE	**Loamy 18-22 P.Z.** Loamy 18-22 PZ ecological sites may be found adjacent to but typically on a lower landscape position than Shallow Limy ecological sites.
R066XY054NE	**Sandy 22-25 P.Z.** Sandy 22-25 PZ ecological sites may be found adjacent to but typically on a lower landscape position than Shallow Limy ecological sites.
R066XY059NE	**Thin Upland** Thin Upland ecological sites may be found adjacent to but typically on a slightly lower landscape position than Shallow Limy ecological sites.
R066XY058NE	**Loamy 22-25 P.Z.** Loamy 22-25 PZ ecological sites may be found adjacent to but typically on a lower landscape position than Shallow Limy ecological sites.

Similar sites

R066XY059NE	**Thin Upland** Thin Upland and Shallow Limy ecological site occurs on similar landscape positions similar but Shallow Limy sites have bedrock within 20 inches of the soil surface while Thin Upland sites do not.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Schizachyrium scoparium* (2) *Bouteloua curtipendula*

Physiographic features

The Shallow Limy ecological site typically occurs on hillslopes and hills, valley sides, and knolls but is sometimes found on plains, sand sheets, buttes, and ridges.

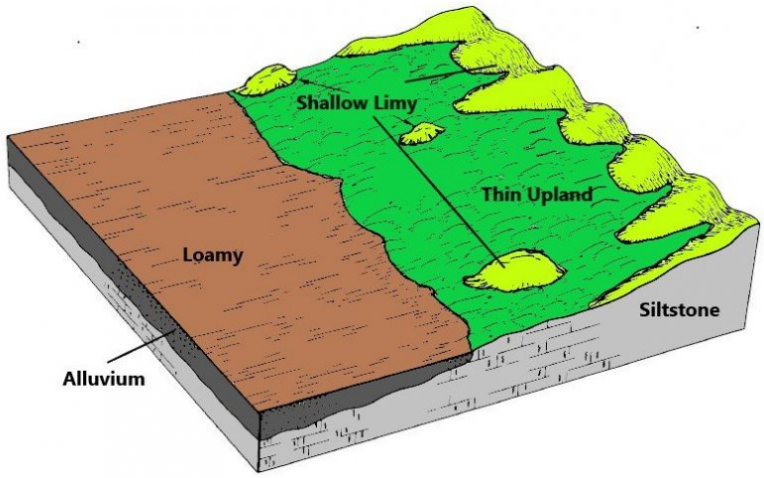


Figure 2. Block diagram for the Shallow Limy ecological site.

Table 2. Representative physiographic features

Landforms	(1) Hillslope (2) Hill (3) Valley side (4) Knoll
Runoff class	Very low to very high
Flooding frequency	None
Ponding frequency	None
Elevation	579–914 m
Slope	0–60%
Water table depth	203 cm
Aspect	Aspect is not a significant factor

Climatic features

MLRA 66 is considered to have a continental climate with cold winters and hot summers, low humidity, light rainfall, and much sunshine. Extremes in temperature may also abound. The climate is the result of this MLRA's location near the geographic center of North America. There are few natural barriers on the northern Great Plains and the winds move freely across the plains and account for rapid changes in temperature.

Annual precipitation ranges from 18 to 25 inches per year. The normal average annual temperature is about 48°F. January is the coldest month with average temperatures ranging from about 19°F (Bonesteel, SD) to about 23°F (Ainsworth, NE). July is the warmest month with temperatures averaging from about 73°F (Harrington, SD) to about 75°F (Gregory, SD). The range of normal average monthly temperatures between the coldest and warmest months is about 54°F. This large annual range attests to the continental nature of the climate this area. Hourly winds average about ten miles per hour annually, ranging from about 11 miles per hour during the spring to about nine miles per hour during the summer. Daytime winds are generally stronger than nighttime and occasional strong storms may bring brief periods of high winds with gusts to more than 50 miles per hour.

Growth of native cool-season plants begins mid to late March and continues to late June. Native warm-season plants begin growth in early May and continue to late August. Green-up of cool-season plants may occur in September and October when adequate soil moisture is present.

Table 3. Representative climatic features

Frost-free period (characteristic range)	111-124 days
Freeze-free period (characteristic range)	129-139 days

Precipitation total (characteristic range)	533-635 mm
Frost-free period (actual range)	72-128 days
Freeze-free period (actual range)	83-146 days
Precipitation total (actual range)	508-660 mm
Frost-free period (average)	110 days
Freeze-free period (average)	128 days
Precipitation total (average)	584 mm

Climate stations used

- (1) HARRINGTON [USC00393574], Tuthill, SD
- (2) MISSION [USC00395620], Mission, SD
- (3) MISSION 14 S [USC00395638], Mission, SD
- (4) KILGORE 1NE [USC00254432], Kilgore, NE
- (5) VALENTINE MILLER FLD [USW00024032], Valentine, NE
- (6) WINNER WILEY FLD [USW00094990], Winner, SD
- (7) GREGORY [USC00393452], Gregory, SD
- (8) SPRINGVIEW [USC00258090], Springview, NE
- (9) AINSWORTH [USC00250050], Ainsworth, NE
- (10) NEWPORT [USC00255925], Newport, NE
- (11) FAIRFAX #2 [USC00392822], Fairfax, SD
- (12) BUTTE [USC00251365], Butte, NE

Influencing water features

No significant water features influence this site.

Soil features

The primary characteristic of soils correlated to the Shallow Limy ecological site are the very shallow to shallow (20 inches or less) depths to bedrock. The soil surface textures range from loamy fine sand to silt loam. Soils are formed in sandy and loamy residuum from calcareous sandstone, sandstone, limestone, or siltstone. Slopes are typically 6 to 30 percent but range from 0 to 70 percent. The soils are well to excessively drained.

This site should show slight to no evidence of rills, wind scoured areas, or pedestalled plants. Water flow paths are broken, irregular in appearance, or discontinuous with numerous debris dams or vegetative barriers. The soil surface is stable and intact. Sub-surface soil layers are restrictive to water movement and root penetration. These soils are susceptible to water erosion when slopes exceed 15 percent and the hazard of water erosion increases as slopes increase. Low available water capacity caused by the shallow rooting depth strongly influences the soil-water-plant relationship.

The soil series correlated to this site are Longpine, Tassel, Mariaville, Canyon, Epping, Shena, and Fishberry. More information can be found in the various soil survey reports. Contact the local USDA Service Center for soil survey reports that include more detail specific to your location or visit Web Soil Survey (https://websoilsurvey.sc.egov.usda.gov).

Figure 9. Fishberry series profile

Table 4. Representative soil features

Parent material	(1) Residuum–calcareous sandstone (2) Residuum–limestone (3) Residuum–siltstone (4) Residuum–sandstone
Surface texture	(1) Fine sandy loam (2) Loamy fine sand (3) Loam (4) Silt loam (5) Loamy sand (6) Very fine sandy loam
Family particle size	(1) Loamy
Drainage class	Well drained to excessively drained
Permeability class	Very slow to rapid
Depth to restrictive layer	15–51 cm
Soil depth	15–51 cm
Surface fragment cover <=3"	0–12%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	1.78–8.38 cm
Calcium carbonate equivalent (0-101.6cm)	0–15%
Electrical conductivity (0-101.6cm)	0–2 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–6
Soil reaction (1:1 water) (0-101.6cm)	6.6–8.4
Subsurface fragment volume <=3" (Depth not specified)	0–36%
Subsurface fragment volume >3" (Depth not specified)	0–5%

Ecological dynamics

Shallow Limy ecological sites developed under Northern Great Plains climatic conditions, light to severe grazing by

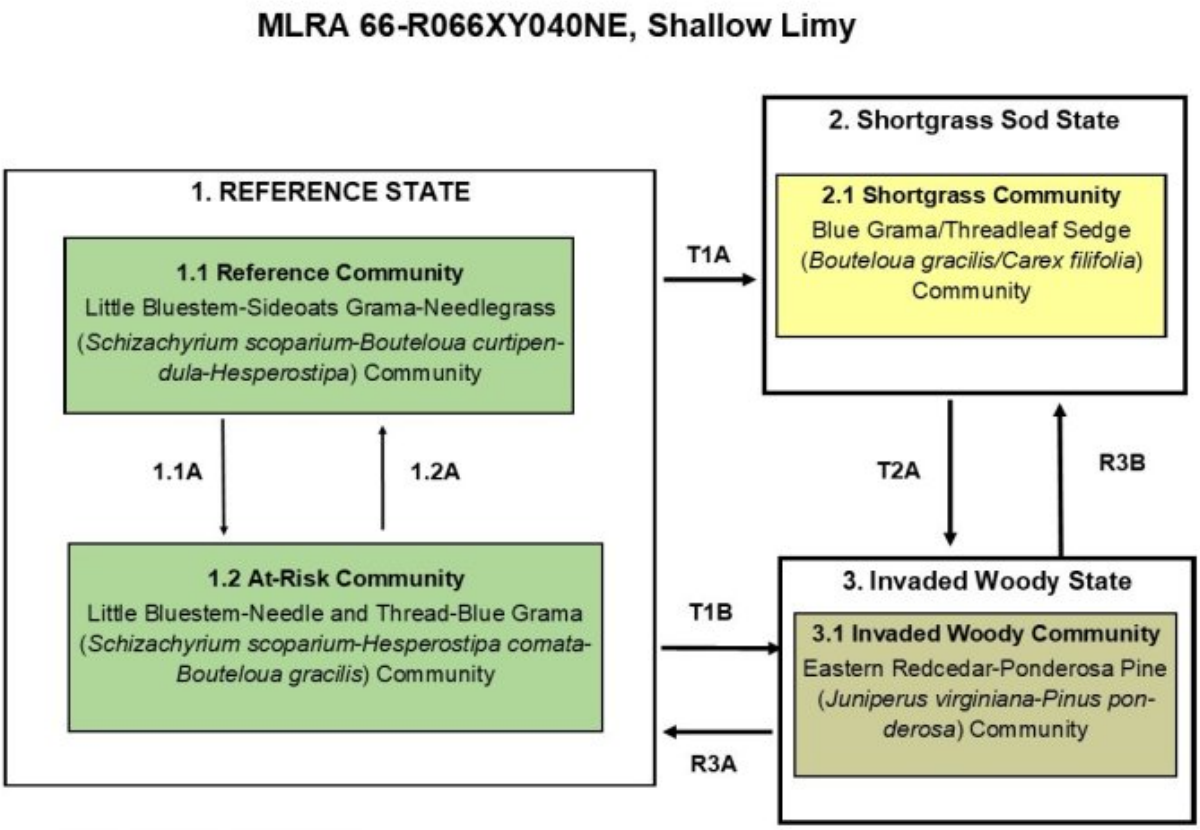
bison and other large herbivores, sporadic natural or man-caused wildfire, and other biotic and abiotic factors that typically influence soil and site development. This continues to be a disturbance-driven site with herbivory, fire, and variable climate being the primary disturbances. Changes occur in the plant communities due to short-term weather variations, impacts of native and exotic plant and animal species, and management actions.

The introduction of domestic livestock by European settlers along with season-long, continuous grazing had a profound impact on the vegetation of the Shallow Limy ecological site. Season-long, continuous grazing causes a repeated removal of the growing point and excessive defoliation of the leaf area of individual warm-season tallgrasses. The resulting reduction in the ability of the plants to harvest sunlight depletes root reserves, subsequently decreasing root mass. The ability of the plants to compete for nutrients is impaired, resulting in decreased vigor and eventual mortality. Species that evade negative grazing impacts through mechanisms such as a growing season adaptation (i.e., cool-season), growing points located near the soil surface, a shorter structure, or reduced palatability will increase. As this site deteriorates, blue grama, hairy grama, needle and thread, and threadleaf sedge increase as a proportion of the plant community while warm-season tallgrasses and sideoats grama decrease in frequency and production.

The State and Transition Model (STM) is depicted below and includes a Reference State (1), a Shortgrass Sod State (2), and an Invaded Woody State (3). Each state represents the crossing of a major ecological threshold due to the alteration of the functional dynamic properties of the ecosystem. The primary properties observed to determine this change are soil stability, vegetative communities, and the hydrologic cycle. Each state may have one or more plant communities that fluctuate in species composition and abundance within the normal parameters of the state. Within each state, communities may degrade or recover in response to natural and man caused disturbances such as variation in the degree and timing of herbivory, presence or absence of fire, and climatic and local fluctuations in the precipitation regime. The processes that cause the movement between the states and communities are discussed in more detail in the state and community descriptions following the diagram.

Interpretations are primarily based on the Reference Community (1.1). It has been determined by study of rangeland relic areas, areas protected from excessive disturbance, and areas under long-term rotational grazing regimes. Trends in plant community dynamics ranging from heavily grazed to lightly grazed areas, seasonal use pastures, and historical accounts have been used as well. Plant communities, states, transitional pathways, and thresholds have been determined through similar studies and experience.

State and transition model



Transitions and Restorations:
T1A: Long-term (>10 years) heavy grazing.
T1B: Woody encroachment and no fire or woody species management..
T2A: Woody encroachment and no fire or woody species management..
R3A: Prescribed burning, wildfire, timber harvest, brush management.
R3B: Prescribed burning, wildfire, timber harvest, brush management.

Community Pathways:
1.1A: Continuous seasonal, continuous season-long, or rotational grazing with inadequate recovery periods.
1.2A: Prescribed grazing with adequate growing season recovery periods.

Figure 10. State and Transition Model Diagram. MLRA 66, Shallow Limy Ecological Site.

State 1
Reference State

The Reference State (1) describes the range of vegetative community phases that occur on the Shallow Limy ecological site where the range of natural variability under historic conditions and disturbance regimes is mostly intact. The Reference State developed under the combined influences of climatic conditions, periodic fire activity, grazing by large herbivores, and impacts from small mammals and insects. High perennial grass cover and production allows for increased soil moisture retention, vegetative production and overall soil quality. The Reference State includes the Reference Community (1.1) and the At-Risk Community (1.2). The Reference Community (1.1) serves as a description of the native plant community that naturally occurs on the site when the natural disturbance regimes are intact or closely mimicked by management practices. The At-Risk Community (1.2) results from management decisions that are unfavorable for a healthy Reference Community.

Dominant plant species

- little bluestem (*Schizachyrium scoparium*), grass
- sideoats grama (*Bouteloua curtipendula*), grass
- needle and thread (*Hesperostipa comata ssp. comata*), grass
- porcupinegrass (*Hesperostipa spartea*), grass
- big bluestem (*Andropogon gerardii*), grass
- blue grama (*Bouteloua gracilis*), grass

Community 1.1
Reference Community

Figure 11. Shallow Limy Ecological Site, Reference Community (1.1), Tripp County, South Dakota.

Interpretations are primarily based on the Reference or Little Bluestem-Sideoats Grama-Needlegrass (*Schizachyrium scoparium*-*Bouteloua curtipendula*-Hesperostipa) Community (1.1). This plant community serves as a description of the native plant community that occurs on the site when the natural disturbance regimes are intact or are closely mimicked by management practices. This phase is dynamic, with fluid relative abundance and spatial boundaries between the dominant structural vegetative groups. These fluctuations are primarily driven by different responses of the species to changes in precipitation timing and abundance, and to fire and grazing events. This site developed with grazing by large herbivores and is well suited for grazing by domestic livestock. The plant community is dominated by a mixture of cool- and warm-season grasses. The major grasses include the little bluestem, sideoats grama, big bluestem, sand bluestem, needle and thread, and porcupine grass. Other grasses and grass-likes occurring include prairie sandreed, blue grama, western wheatgrass, plains muhly, and sedge. Significant forbs include blacksamson echinacea, and purple prairie clover. Shrubs occurring in this plant community include leadplant, rose, prairie sagewort, and soapweed yucca. The potential vegetation is 80 to 90 percent grasses or grass-like plants, 5 to10 percent forbs, and 5 to10 percent shrubs. Natural fire played a significant role in the succession of this site by limiting the extent of eastern redcedar and ponderosa pine. Wildfires have been actively controlled in recent times, allowing expansion of eastern redcedar and ponderosa pine. This plant community can be found on areas that are managed with prescribed grazing, prescribed burning, and may be found on areas receiving occasional periods of short-term rest. This plant community is extremely resilient and well adapted to the Northern Great Plains climatic conditions. The diversity in plant species allows for high tolerance to drought . Community dynamics, nutrient cycle, water cycle, and energy flow are functioning properly. Plant litter is properly distributed with very little movement off-site, and natural plant mortality is very low.

Dominant plant species

- little bluestem (*Schizachyrium scoparium*), grass
- sideoats grama (*Bouteloua curtipendula*), grass
- big bluestem (*Andropogon gerardii*), grass
- needle and thread (*Hesperostipa comata ssp. comata*), grass
- porcupinegrass (*Hesperostipa spartea*), grass
- blacksamson echinacea (*Echinacea angustifolia*), other herbaceous
- white sagebrush (*Artemisia ludoviciana*), other herbaceous
- dotted blazing star (*Liatris punctata*), other herbaceous

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	942	1599	2146
Forb	90	143	196
Shrub/Vine	90	143	196
Tree	–	19	39
Total	**1122**	**1904**	**2577**

Figure 13. Plant community growth curve (percent production by month). NE6637, Eroded Tableland, warm-season dominant, cool-season subdominant.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		5	8	15	24	23	15	5	5		

Community 1.2
At-Risk Community

Figure 14. Shallow Limy Ecological Site, At-Risk Community (1.2), Tripp County, South Dakota.

The At-Risk or the Little Bluestem-Needle and Thread-Blue Grama (*Schizachyrium scoparium-Hesperostipa comata-Bouteloua gracilis*) Community (1.2) develops under continuous seasonal grazing, rotational grazing with inadequate growing season recovery periods, or in some cases with low stock densities under continuous season-long grazing. Needle and thread, little bluestem, and blue grama are significant species in this plant community. As compared to the Reference Community (1.1), big bluestem and sideoats grama have decreased while warm-season shortgrasses and grass-likes, such as blue grama, hairy grama, and sedge have increased. Common forbs include white sagebrush, tarragon, and scurfpea. Significant shrubs include yucca, cactus, rose, and prairie sagewort. Non-native cool-season grasses may be beginning to invade the plant community. The potential vegetation is 85 to 90 percent grasses or grass-like plants, 5 to10 percent forbs, and 2 to 8 percent shrubs. This plant community is moderately resistant to change. The herbaceous species present are well adapted to grazing;

however, species composition can be altered through long-term overgrazing. If the herbaceous component is intact, it tends to be resilient if the disturbance is not long-term. Without a management change, this community is at-risk to transition to the Shortgrass Sod State (2).

Dominant plant species

- little bluestem (*Schizachyrium scoparium*), grass
- needle and thread (*Hesperostipa comata ssp. comata*), grass
- blue grama (*Bouteloua gracilis*), grass
- sideoats grama (*Bouteloua curtipendula*), grass

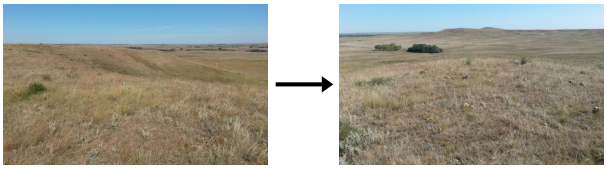
Table 6. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	796	1357	1805
Forb	73	118	163
Shrub/Vine	28	78	129
Tree	–	16	34
Total	**897**	**1569**	**2131**

Figure 16. Plant community growth curve (percent production by month). NE6637, Eroded Tableland, warm-season dominant, cool-season subdominant.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		5	8	15	24	23	15	5	5		

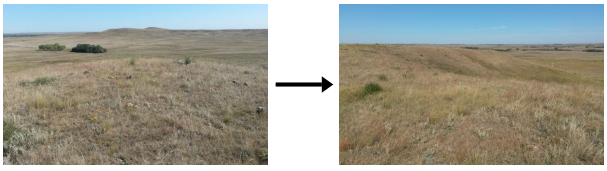
Pathway 1.1A
Community 1.1 to 1.2



Reference Community **At-Risk Community**

Continuous seasonal grazing, continuous season-long grazing with low stock densities, or rotational grazing with inadequate growing season recovery periods will convert the Reference Community (1.1) to the At-Risk Community (1.2).

Pathway 1.2A
Community 1.2 to 1.1



At-Risk Community **Reference Community**

Prescribed grazing with adequate growing season recovery periods will convert the At-Risk Community (1.2) to the Reference Community (1.1).

State 2
Shortgrass Sod State

The Reference State (1) has been degraded and transitioned to the Shortgrass Sod State (2). Much of the native

warm-season tall- and midgrass components have been replaced by warm-season, sod-forming shortgrasses and threadleaf sedge. Non-native, cool-season grasses may have a significant presence in the plant community. The loss of warm-season, tall- and midgrasses has negatively impacted energy flow and nutrient cycling. Water infiltration is reduced due to the shallow root system and rapid runoff characteristics of the shortgrass sod communities. The Shortgrass Sod State includes the Shortgrass Community (2.1).

Dominant plant species

- blue grama (*Bouteloua gracilis*), grass
- Kentucky bluegrass (*Poa pratensis*), grass
- threadleaf sedge (*Carex filifolia*), other herbaceous

Community 2.1
Shortgrass Community

Figure 17. Shallow Limy Ecological Site, Shortgrass Sod Community (2.1), Knox County, Nebraska.

The Shortgrass or Blue Grama/Threadleaf Sedge (*Bouteloua gracilis*/*Carex filifolia*) Community (2.1) develops with long-term (greater than 10 years) heavy grazing. Grazing tolerant species such as blue grama, hairy grama, and threadleaf sedge replace big bluestem, little bluestem, western wheatgrass, green needlegrass, and needle and thread. Sideoats grama initially is present in a reduced vigor condition but as heavy mid-summer grazing pressure continues, it is reduced to a remnant. As heavy grazing pressure continues, prairie sagewort, white sagebrush, soapweed yucca, tarragon, Cuman ragweed, and pricklypear become more prevalent in the plant community. The potential vegetation is 80 to 90 percent grasses or grass-like plants, 5 to10 percent forbs, and 2 to10 percent shrubs. The Shortgrass Community is typically resistant to change. As the shortgrasses become dominant in the plant community, plant diversity decreases. Non-native species such as Kentucky bluegrass and cheatgrass maybe a significant part the plant community. Runoff will increase and infiltration will decrease compared to the Reference Community (1.1) as the sod forming grasses become dominant in the plant community. Continued heavy grazing results in a considerable increase in bare ground and high erosion potential.

Dominant plant species

- blue grama (*Bouteloua gracilis*), grass
- hairy grama (*Bouteloua hirsuta*), grass
- sedge (*Carex*), other herbaceous

Table 7. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	493	958	1418
Forb	50	84	118
Shrub/Vine	17	67	118
Tree	–	11	28
Total	**560**	**1120**	**1682**

Figure 19. Plant community growth curve (percent production by month). NE6636, Eroded Tableland, cool-season/warm-season codominant.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		5	10	20	25	20	10	5	5		

State 3
Invaded Woody State

The Invaded Woody State (3) is the result of woody encroachment. Once the tree canopy cover reaches 15 percent with an average tree height exceeding five feet, the threshold to the Invaded Woody State has been crossed. Woody species are increasing due to the lack of prescribed fire, brush management, or other woody tree removal. Typical ecological impacts are a loss of native grasses, reduced diversity of functional and structural groups, reduced forage production, and reduced soil quality. Prescribed burning, wildfire, timber harvest and brush management will move the Invaded Woody State toward a grass dominated state. If the Invaded Woody State transitioned from Shortgrass Sod State (2), the land cannot return to the Reference State (1) as the native plant community, soils, and hydrologic function had been too severely impacted prior to the woody encroachment to allow the return to the Reference State through woody species removal alone. The Invaded Woody State includes one community, the Invaded Woody Community (3.1).

Dominant plant species

- eastern redcedar (*Juniperus virginiana*), tree
- ponderosa pine (*Pinus ponderosa*), tree
- smooth sumac (*Rhus glabra*), shrub
- needle and thread (*Hesperostipa*), grass
- green needlegrass (*Nassella viridula*), grass
- Kentucky bluegrass (*Poa pratensis*), grass
- threadleaf sedge (*Carex filifolia*), other herbaceous

Community 3.1
Invaded Woody Community

The Invaded Woody or Eastern Redcedar-Ponderosa Pine (*Juniperus virginiana-Pinus ponderosa*) Community (3.1) has at least 15 percent canopy cover consisting of trees generally 5 feet or taller. Encroaching trees are primarily eastern redcedar but may include ponderosa pine or deciduous trees and shrubs. In the absence of fire and brush management, this ecological site is very susceptible to eastern redcedar and, when conditions are conducive to germination, ponderosa pine seedling invasion, especially when adjacent to a seed source. Historically, periodic fire prevented woody species encroachment confining ponderosa pine and juniper to ridges and the steepest portions of the ecological site. Fire suppression facilitates the encroachment of eastern redcedar, ponderosa pine, and other woody species onto the less steep portion of the Shallow Limy ecological site. Dominant grasses and grass-likes include needle and thread, green needlegrass, Canada wildrye, and Kentucky bluegrass. Grasses and grass-likes of secondary importance include sedge, blue grama, western wheatgrass, and cheatgrass. Forbs commonly found in this community include white sagebrush, goldenrod, tarragon, and Cuman ragweed. Non-native species such as cheatgrass and Kentucky bluegrass are typically present in this plant community. When compared to the Reference Community (1.1), ponderosa pine or eastern redcedar have increased significantly. As the buildup of duff increases, the grass component of the plant community will decrease dramatically and annual production of the understory decreases significantly. Total annual production during an average year varies

significantly, depending on the production level prior to encroachment and the percentage of canopy cover. While the tree canopy provides excellent protection from the weather for livestock and wildlife, decreased forage production reduces the carrying capacity for both domestic livestock and wildlife and significantly reduces habitat for grassland birds. This plant community is resistant to change. A significant reduction of eastern redcedar and ponderosa pine can only be accomplished through timber harvesting or crown fire. The vegetation in the understory is capable of surviving fire; however, very hot crown fires will have a detrimental effect to the plant community. Reclamation of tree dominated areas using mechanical methods is quite costly and temporary without proper management including prescribed burning, timber harvest, and brush management.

Dominant plant species

- eastern redcedar (*Juniperus virginiana*), tree
- ponderosa pine (*Pinus ponderosa*), tree
- Canada wildrye (*Elymus canadensis*), tree
- needle and thread (*Hesperostipa comata ssp. comata*), tree
- rose (*Rosa*), shrub
- prairie sagewort (*Artemisia frigida*), shrub
- Kentucky bluegrass (*Poa pratensis*), grass
- green needlegrass (*Nassella viridula*), grass
- white sagebrush (*Artemisia ludoviciana*), other herbaceous
- goldenrod (*Solidago*), other herbaceous
- threadleaf sedge (*Carex filifolia*), other herbaceous

Figure 20. Plant community growth curve (percent production by month). NE6644, Eroded Tableland, heavy conifer canopy.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	3	7	10	20	28	15	5	4	4	2	1

Transition T1A
State 1 to 2

Long-term (more than 10 years) heavy grazing will cause the Reference State (1) to lose a significant proportion of warm-season, tall- and midgrass species and cross a threshold to the Shortgrass Sod State (2). Water infiltration and other hydrologic functions will be reduced due to the root-matting presence of sod-forming grasses. With the decline and loss of deeper-penetrating root systems, soil structure and biological integrity are catastrophically degraded to the point that recovery is unlikely. Once this occurs, it is highly unlikely that grazing management alone will return the site to the Reference State.

Transition T1B
State 1 to 3

Disruption of the natural fire regime, encroachment of invasive exotic and native woody species will cause the Reference State (1) to transition to the Invaded Woody State (3) if woody species control measures are not implemented.

Transition T2A
State 2 to 3

Disruption of the natural fire regime, encroachment of invasive exotic and native woody species with no woody species management will cause the Shortgrass Sod State (2) to transition to the Invaded Woody State (3) if woody species control measures are not implemented. .

Restoration pathway R3A
State 3 to 1

Prescribed burning, wildfire, timber harvest, and brush management will move the Invaded Woody State (3) toward the Reference State (1). The forb component may initially increase following tree removal. Ongoing brush

management such as hand cutting, chemical spot treatments, or periodic prescribed burning is required to prevent a return to the Invaded Woody State. The heavier the existing canopy cover, the greater the energy input required to return to the Reference State by management practices. The amount of time required for this restoration to occur depends on the severity and duration of the encroachment. Land that transitioned to the Invaded Woody State from the Shortgrass Sod State (2) cannot be restored to the Reference State through removal of woody species as the native plant community, soils, and hydrologic function have been too severely impacted for that restoration to occur.

Restoration pathway R3B
State 3 to 2

Prescribed burning, wildfire, timber harvest, and brush management will move the Invaded Woody State (3) toward the Shortgrass Sod State (2). The forb component may initially increase following tree removal. Ongoing brush management such as hand cutting, chemical spot treatments, or periodic prescribed burning is required to prevent a return to the Invaded Woody State. The heavier the existing canopy cover, the greater the energy input required to return to the Shortgrass Sod State by management practices. The amount of time required for this restoration to occur depends on the severity and duration of the encroachment. Land that transitioned to the Invaded Woody State from the Shortgrass Sod State cannot be restored to the Reference State (1) through removal of woody species as the native plant community, soils, and hydrologic function have been too severely impacted for that restoration to occur.

Additional community tables

Table 8. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Warm-Season Midgrass**			286–572	
	little bluestem	SCSC	*Schizachyrium scoparium*	191–476	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	191–476	–
	plains muhly	MUCU3	*Muhlenbergia cuspidata*	38–191	–
	purple lovegrass	ERSP	*Eragrostis spectabilis*	0–95	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	19–57	–
	Grass, perennial	2GP	*Grass, perennial*	0–38	–
2	**Warm-Season Tallgrass**			286–476	
	big bluestem	ANGE	*Andropogon gerardii*	95–381	–
	sand bluestem	ANHA	*Andropogon hallii*	95–381	–
	prairie sandreed	CALO	*Calamovilfa longifolia*	38–191	–
	switchgrass	PAVI2	*Panicum virgatum*	0–95	–
	Indiangrass	SONU2	*Sorghastrum nutans*	0–95	–
3	**Cool-Season Bunchgrass**			191–476	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	95–286	–
	porcupinegrass	HESP11	*Hesperostipa spartea*	95–286	–
	green needlegrass	NAVI4	*Nassella viridula*	38–191	–
	Canada wildrye	ELCA4	*Elymus canadensis*	0–57	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	19–57	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	0–38	–
	fall rosette grass	DIWI5	*Dichanthelium wilcoxianum*	0–38	–
	Grass, perennial	2GP	*Grass, perennial*	0–38	–
4	**Warm-Season Shortgrass**			95–286	

	blue grama	BOGR2	*Bouteloua gracilis*	95–191	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	19–95	–
	buffalograss	BODA2	*Bouteloua dactyloides*	0–95	–
	threeawn	ARIST	*Aristida*	0–38	–
	Grass, perennial	2GP	*Grass, perennial*	0–19	–
5	**Cool-Season Rhizomatous Grass**			38–191	
	western wheatgrass	PASM	*Pascopyrum smithii*	38–191	–
9	**Grass-like**			0–38	
	threadleaf sedge	CAFI	*Carex filifolia*	0–38	–
	sedge	CAREX	*Carex*	0–38	–
Forb					
6	**Forb**			95–191	
	scurfpea	PSORA2	*Psoralidium*	19–57	–
	Forb, native	2FN	*Forb, native*	19–57	–
	tarragon	ARDR4	*Artemisia dracunculus*	19–57	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	19–57	–
	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	19–57	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	19–57	–
	dotted blazing star	LIPU	*Liatris punctata*	19–38	–
	wavyleaf thistle	CIUN	*Cirsium undulatum*	0–38	–
	milkvetch	ASTRA	*Astragalus*	19–38	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–38	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	19–38	–
	goldenrod	SOLID	*Solidago*	19–38	–
	purple prairie clover	DAPU5	*Dalea purpurea*	19–38	–
	stiff sunflower	HEPA19	*Helianthus pauciflorus*	19–38	–
	Nuttall's sensitive-briar	MINU6	*Mimosa nuttallii*	0–38	–
	American vetch	VIAM	*Vicia americana*	19–38	–
	beardtongue	PENST	*Penstemon*	19–38	–
	spiny phlox	PHHO	*Phlox hoodii*	0–19	–
	purple locoweed	OXLA3	*Oxytropis lambertii*	0–19	–
	Indian breadroot	PEDIO2	*Pediomelum*	0–19	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–19	–
	white heath aster	SYER	*Symphyotrichum ericoides*	0–19	–
	stemless four-nerve daisy	TEACA2	*Tetraneuris acaulis var. acaulis*	0–19	–
	pussytoes	ANTEN	*Antennaria*	0–19	–
	textile onion	ALTE	*Allium textile*	0–19	–
	onion	ALLIU	*Allium*	0–19	–
	yellow sundrops	CASE12	*Calylophus serrulatus*	0–19	–
	white prairie clover	DACA7	*Dalea candida*	0–19	–
	scarlet beeblossom	GACO5	*Gaura coccinea*	0–19	–
	American bird's-foot	LOUNU	*Lotus unifoliolatus var. unifoliolatus*	0–19	–

	trefoil				
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–19	–
	lacy tansyaster	MAPI	*Machaeranthera pinnatifida*	0–19	–
Shrub/Vine					
7	**Shrub**			95–191	
	leadplant	AMCA6	*Amorpha canescens*	19–95	–
	prairie sagewort	ARFR4	*Artemisia frigida*	19–57	–
	smooth sumac	RHGL	*Rhus glabra*	0–57	–
	rose	ROSA5	*Rosa*	19–57	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–57	–
Tree					
8	**Tree**			0–38	
	Tree	2TREE	*Tree*	0–38	–
	eastern redcedar	JUVI	*Juniperus virginiana*	0–38	–
	ponderosa pine	PIPO	*Pinus ponderosa*	0–38	–

Table 9. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Warm-Season Midgrass**			314–549	
	little bluestem	SCSC	*Schizachyrium scoparium*	235–549	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	78–235	–
	purple lovegrass	ERSP	*Eragrostis spectabilis*	0–126	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	16–78	–
	plains muhly	MUCU3	*Muhlenbergia cuspidata*	16–78	–
2	**Warm-Season Tallgrass**			31–126	
	prairie sandreed	CALO	*Calamovilfa longifolia*	31–126	–
	big bluestem	ANGE	*Andropogon gerardii*	0–78	–
	sand bluestem	ANHA	*Andropogon hallii*	0–78	–
	Grass, perennial	2GP	*Grass, perennial*	0–16	–
3	**Cool-Season Bunchgrass**			157–392	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	157–314	–
	porcupinegrass	HESP11	*Hesperostipa spartea*	0–78	–
	green needlegrass	NAVI4	*Nassella viridula*	0–78	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	16–47	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	16–31	–
	fall rosette grass	DIWI5	*Dichanthelium wilcoxianum*	0–31	–
	Grass, perennial	2GP	*Grass, perennial*	0–16	–
4	**Warm-Season Shortgrass**			78–314	
	blue grama	BOGR2	*Bouteloua gracilis*	78–235	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	16–157	–
	buffalograss	BODA2	*Bouteloua dactyloides*	0–126	–
	threeawn	ARIST	*Aristida*	16–78	–

5	**Cool-Season Rhizomatous Grass**			31–126	
	western wheatgrass	PASM	*Pascopyrum smithii*	31–126	–
6	**Grass-Like**			31–157	
	threadleaf sedge	CAFI	*Carex filifolia*	31–157	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–78	–
7	**Non-Native Cool-Season Grass**			31–78	
	Kentucky bluegrass	POPR	*Poa pratensis*	16–78	–
	cheatgrass	BRTE	*Bromus tectorum*	16–47	–
	smooth brome	BRIN2	*Bromus inermis*	0–47	–
Forb					
8	**Forb**			78–157	
	white sagebrush	ARLU	*Artemisia ludoviciana*	31–78	–
	field sagewort	ARCA12	*Artemisia campestris*	16–78	–
	Forb, annual	2FA	*Forb, annual*	0–63	–
	goldenrod	SOLID	*Solidago*	16–63	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	16–63	–
	scurfpea	PSORA2	*Psoralidium*	16–63	–
	wavyleaf thistle	CIUN	*Cirsium undulatum*	16–47	–
	Forb, perennial	2FP	*Forb, perennial*	16–47	–
	white heath aster	SYER	*Symphyotrichum ericoides*	16–47	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	0–31	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	16–31	–
	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	0–31	–
	purple prairie clover	DAPU5	*Dalea purpurea*	0–16	–
	pussytoes	ANTEN	*Antennaria*	0–16	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–16	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–16	–
	spiny phlox	PHHO	*Phlox hoodii*	0–16	–
	stemless four-nerve daisy	TEACA2	*Tetraneuris acaulis var. acaulis*	0–16	–
	stiff sunflower	HEPA19	*Helianthus pauciflorus*	0–16	–
	onion	ALLIU	*Allium*	0–16	–
	large Indian breadroot	PEES	*Pediomelum esculentum*	0–16	–
	purple locoweed	OXLA3	*Oxytropis lambertii*	0–16	–
	milkvetch	ASTRA	*Astragalus*	0–16	–
	beardtongue	PENST	*Penstemon*	0–16	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	0–16	–
	dotted blazing star	LIPU	*Liatris punctata*	0–16	–
	American vetch	VIAM	*Vicia americana*	0–16	–
Shrub/Vine					
9	**Shrub**			31–126	
	prairie sagewort	ARFR4	*Artemisia frigida*	16–78	–

	smooth sumac	RHGL	*Rhus glabra*	0–78	–
	soapweed yucca	YUGL	*Yucca glauca*	0–63	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	16–47	–
	rose	ROSA5	*Rosa*	16–47	–
	skunkbush sumac	RHTR	*Rhus trilobata*	0–31	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–31	–
	leadplant	AMCA6	*Amorpha canescens*	0–31	–
Tree					
10	**Tree**			0–31	
	eastern redcedar	JUVI	*Juniperus virginiana*	0–31	–
	ponderosa pine	PIPO	*Pinus ponderosa*	0–31	–
	Tree	2TREE	*Tree*	0–31	–

Table 10. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Warm-Season Midgrass**			11–135	
	little bluestem	SCSC	*Schizachyrium scoparium*	0–112	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	0–112	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	22–90	–
	purple lovegrass	ERSP	*Eragrostis spectabilis*	0–56	–
	Grass, perennial	2GP	*Grass, perennial*	0–22	–
2	**Warm-Season Tallgrass**			0–56	
	prairie sandreed	CALO	*Calamovilfa longifolia*	0–56	–
	Grass, perennial	2GP	*Grass, perennial*	0–22	–
3	**Cool-Season Bunchgrass**			22–112	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	22–112	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	0–22	–
	fall rosette grass	DIWI5	*Dichanthelium wilcoxianum*	0–22	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–22	–
	Grass, perennial	2GP	*Grass, perennial*	0–22	–
4	**Warm-Season Shortgrass**			224–392	
	blue grama	BOGR2	*Bouteloua gracilis*	168–392	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	56–168	–
	threeawn	ARIST	*Aristida*	22–112	–
	buffalograss	BODA2	*Bouteloua dactyloides*	0–112	–
5	**Cool-Season Rhizomatous Grass**			11–56	
	western wheatgrass	PASM	*Pascopyrum smithii*	11–56	–
6	**Grass-Like**			56–202	
	threadleaf sedge	CAFI	*Carex filifolia*	56–202	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–112	–
7	**Non-Native Grass**			56–168	

	cheatgrass	BRTE	*Bromus tectorum*	22–168	–
	Kentucky bluegrass	POPR	*Poa pratensis*	22–168	–
	smooth brome	BRIN2	*Bromus inermis*	0–56	–
Forb					
8	**Forb**			56–112	
	tarragon	ARDR4	*Artemisia dracunculus*	22–78	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	22–78	–
	sweetclover	MELIL	*Melilotus*	0–78	–
	Forb, introduced	2FI	*Forb, introduced*	0–67	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	11–67	–
	goldenrod	SOLID	*Solidago*	11–56	–
	white heath aster	SYER	*Symphyotrichum ericoides*	11–45	–
	goatsbeard	TRAGO	*Tragopogon*	11–45	–
	scurfpea	PSORA2	*Psoralidium*	11–45	–
	wavyleaf thistle	CIUN	*Cirsium undulatum*	0–34	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	0–34	–
	Forb, native	2FN	*Forb, native*	0–22	–
	pussytoes	ANTEN	*Antennaria*	0–11	–
	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	0–11	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–11	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–11	–
	purple locoweed	OXLA3	*Oxytropis lambertii*	0–11	–
	spiny phlox	PHHO	*Phlox hoodii*	0–11	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–11	–
Shrub/Vine					
9	**Shrub**			22–112	
	prairie sagewort	ARFR4	*Artemisia frigida*	22–90	–
	smooth sumac	RHGL	*Rhus glabra*	0–90	–
	soapweed yucca	YUGL	*Yucca glauca*	0–56	–
	rose	ROSA5	*Rosa*	11–45	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	11–45	–
	skunkbush sumac	RHTR	*Rhus trilobata*	0–34	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–11	–
Tree					
10	**Tree**			0–22	
	eastern redcedar	JUVI	*Juniperus virginiana*	0–22	–
	ponderosa pine	PIPO	*Pinus ponderosa*	0–22	–

Animal community

LIVESTOCK - GRAZING INTERPRETATIONS:
Grazing by domestic livestock is one of the major income-producing industries in the area. Rangeland in this area may provide year-long forage for cattle, sheep, or horses. During the dormant period, the protein levels of the forage may be lower than the minimum needed to meet livestock (primarily cattle and sheep)requirements. The

following table lists suggested stocking rates for cattle under continuous season-long grazing under normal growing conditions. These are conservative estimates that should be used only as guidelines in the initial stages of the conservation planning process. Often, the current plant composition does not entirely match any particular plant community (as described in this ecological site description). Because of this, a field visit is recommended, in all cases, to document plant composition and production. More precise carrying capacity estimates should eventually be calculated using this information along with animal preference data, particularly when grazers other than cattle are involved. With consultation of the land manager, more intensive grazing management may result in improved harvest efficiencies and increased carrying capacity.

Production and Carrying Capacity*
Community 1.1, Reference Community: 1,700 lbs/acre, 0.47 AUM/acre
Community 1.2, At-Risk Grass Community: 1,400 lbs/ac, 0.38 AUM/acre
Community 2.1, Shortgrass Sod Community: 1,000 lbs/ac, 0.27 AUM/acre

*Based upon the following conditions: continuous season-long grazing by cattle under average growing conditions, 25 percent harvest efficiency. Air dry forage requirements based on 3 percent of animal body weight, or 912 lbs/AU/month.

WILDLIFE INTERPRETATIONS:
Major Land Resource Area (MLRA) 66 lies primarily within the Mixed-grass prairie ecosystem. Though European settlers have converted about a quarter of this landscape to farmland, the majority of the prairie is still intact. This area still consists of diverse grassland habitats interspersed with varying densities of depressional wetlands and limited woody riparian corridors. These habitats historically provided critical life cycle components for the grassland birds, prairie dogs, and herds of roaming bison, elk, and pronghorn. Bobcats, wolves, and mountain lions occupied the apex predator niche. Diverse populations of small mammals and insects still provide a bountiful prey base for raptors and omnivores such as coyotes, foxes, raccoons, and opossums. In addition, a wide variety of reptiles and amphibians thrive in this landscape.

The Mixed-Grass Prairie was a disturbance-driven ecosystem with fire, herbivory, and climate functioning as the primary disturbances. Following European settlement, elimination of fire, overgrazing, and some habitat fragmentation significantly altered the appearance and functionality of the entire ecosystem. Bison and prairie dogs were historically keystone species, but free-roaming bison herds have been extirpated in this region. The loss of bison and fire as ecological drivers greatly influenced the character of the remaining native grasslands and the habitats that they provide. Fragmentation has reduced habitat quality for numerous area-sensitive species, as highlighted by the decline of the greater prairie chicken.

Historically, an ecological mosaic of the sites provided habitat for species requiring unfragmented grasslands. Most of these important habitat features and components are intact, providing upland nesting habitat for grassland birds and game birds; nesting and escape cover for waterfowl; forbs and insects for brood-rearing habitat; and a forage source for small and large herbivores.

Disruption of the natural fire regime and lack of appropriate grazing management are the greatest threats to the ecosystem dynamics today. Tree and shrub encroachment from lack of fire creates habitat that favors generalist species such as American robin and mourning dove, and provides perches for raptors, increasing the predation mortality on native bird populations. Introduced species such as smooth bromegrass, Kentucky bluegrass, nodding plumeless thistle (musk thistle), and Canada thistle further degrade the biological integrity of many areas of the prairie.

Hydrological functions

Water is the principal factor limiting herbage production on this site. The site is dominated by soils in hydrologic group D. Infiltration varies from very slow to rapid, and runoff varies from low to high depending on slope and ground cover. In many cases, areas with greater than 75 percent ground cover have the greatest potential for high infiltration and lower runoff. An exception would be where short grasses form a dense sod and dominate the site. Areas where ground cover is less than 50 percent have the greatest potential to have reduced infiltration and higher runoff (refer to Section 4, NRCS National Engineering Handbook for runoff quantities and hydrologic curves).

Recreational uses

This site provides hunting opportunities for upland game species. The wide variety of plants which bloom from spring until fall have an aesthetic value that appeals to visitors.

Wood products

No appreciable wood products are present on the site.

Other products

Seed harvest of native plant species can provide additional income on this site.

Other information

Field Offices (Counties)
Nebraska:
Ainsworth, (Brown, Keya Paha, and Rock)
Neligh, (Antelope)
O'Neill, (Holt)
Valentine, (Cherry)

South Dakota:
Burke, (Gregory)
Martin, (Bennett and Shannon)
White River, (Mellette and Todd)
Winner, (Tripp)

Inventory data references

Information presented here has been derived from NRCS clipping data and other inventory data. Field observations from range-trained personnel were also used. Those involved in developing this site include Wayne Bachman, Soil Scientist, NRCS; Stan Boltz, Range Management Specialist, NRCS; Anna Ferguson, Soil Conservationist, NRCS; Roger Hammer, Soil Scientist, NRCS; Dana Larsen, Range Management Specialist, NRCS; Dave Schmidt, Rangeland Management Specialist, NRCS; Kim Stine, Rangeland Management Specialist, NRCS.

There are 8 SCS-RANGE-417 records from Brown, Keya Paha, Knox, and Cherry counties in Nebraska. The sample period was from 1968 to 1983.

There are also 3 ocular estimates collected in 2002 in Keya Paha County, Nebraska and Todd County, South Dakota.

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USDA, NRCS, various published Soil Surveys

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Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

Author(s)/participant(s)	Original Authors: Stan Boltz Version V Authors: Nadine Bishop, Emily Helms, Jeff Nichols
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Date	11/18/2024
Approved by	Suzanne Mayne-Kinney
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** None. Rills are not expected on this site.

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2. **Presence of water flow patterns:** Slight presence of water flow patterns on slopes exceeding 15 percent. When present they are rare, slightly visible, less than 0.5 inches (1.25 cm) deep, less than 6 inches (15.25 cm) wide, and less than 1 foot (30.5 cm) long. When present they are disconnected and disrupted by perennial vegetation.

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3. **Number and height of erosional pedestals or terracettes:** Typically, none. Pedestals and/or terracettes are not expected to occur on this site. Occasionally, bunch grasses may be pedestalled on slopes greater than 15 percent, with no exposed roots. Drought, wildfire, and prescribed burns should not increase the incidence of pedestals except on the steepest slopes.

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare ground is typically 15 percent or less and patch sizes will be less than 3 inches (7.6 cm). Multi-year drought and/or wildfire can increase bare ground to 20-30 percent for up to two years following the disturbance.

   Bare ground is exposed mineral soil that is not covered by vegetation (basal and/or foliar canopy), litter, standing dead vegetation, gravel/rock, and visible biological curst (e.g., lichen, mosses, algae).

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5. **Number of gullies and erosion associated with gullies:** None. Gullies are not expected on this site.

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6. **Extent of wind scoured, blowouts and/or depositional areas:** None. Wind-scoured and/or depositional areas should not be present.

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7. **Amount of litter movement (describe size and distance expected to travel):** On gently sloping sites (less than 15 percent) litter movement is not expected. As slopes become steeper, small size litter classes will generally move short distances usually less than 12 inches (30 cm). Medium size class litter will move very short distances usually less than 6 inches (15 cm). Coarse litter is not expected to move. Litter debris dams are occasionally present.

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8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Soil stability ratings should typically be 5 to 6, normally 6. Surface organic matter adheres to the soil surface. Soil surface fragments will typically retain structure indefinitely when dipped in distilled water.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** The A-horizon is typically 4 to 12 inches (10 to 31 cm) thick, but some soils are more shallow. Soil colors are dark gray, dark grayish brown, brown or light brownish gray, or grayish brown (values 4 to 6) when dry and very dark gray, very dark grayish brown, dark grayish brown, or dark brown (values 3 to 5) when moist. Structure is weak medium granular, weak fine granular, moderate fine granular.

   See Official Soils Descriptions for additional details; major soil series correlated to the site are Longpine, Tassel,

Mariaville, Canyon, Epping, Shena, and Fishberry.

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** The functional/structural groups provide a combination of rooting depths and structure which positively influences infiltration. Combination of shallow and deep rooted species (mid & tall rhizomatous and tufted perennial cool season grasses) with fine and coarse roots positively influences infiltration. Woody encroachment may negatively influence infiltration. Under some management regimes, shortgrass and threadleaf sedge sod may develop which will also negatively influence infiltration.

    The expected composition of the plant community is 80 to 90 percent perennial grasses and grass-likes, 5 to 10 percent forbs, and 5 to 10 percent shrubs. The perennial grass and grass-like component is made up of C4, rhizomatous, tallgrasses (15-25%); C4, midgrasses (15-30%), C3, bunchgrasses (10-25%), C4, shortgrasses (5-15%), C3, rhizomatous grasses (2-10%); and grass-likes (2-8%).

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11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** None. No compaction layers are expected for this site.

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12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**

    Dominant: Phase 1.1
    1. Native, perennial, C4 midgrass, 255-510 #/ac, 15-30% (3 species minimum): little bluestem, sideoats grama, plains muhly, purple lovegrass, sand dropseed.
    2. Native, perennial, C4 tallgrass, 255-425 #/ac, 15-25% (3 species minimum): big bluestem, sand bluestem, prairie sandreed, switchgrass, Indiangrass.
    3. Native, perennial, C3 bunchgrass, 170-425 #/ac, 10-25% (4 species minimum): needle and thread, porcupinegrass, green needlegrass, Canada wildrye, prairie Junegrass, Scribner's rosette grass, fall rosette grass.

    Phase 1.2
    1. Native, perennial, C4 midgrass, 280-490 #/ac, 20-35% (4 species minimum): little bluestem, sideoats grama, plains muhly, purple lovegrass, sand dropseed.
    2. Native, perennial, C3 bunchgrass, 140-350 #/ac, 10-25% (3 species minimum): needle and thread, porcupinegrass, green needlegrass, Canada wildrye, prairie Junegrass, Scribner's rosette grass, fall rosette grass.

    Sub-dominant: Phase 1.1
    1. Native, perennial, C4 shortgrass, 85-255 #ac, 5-15% (1 species minimum): blue grama, buffalograss, hairy grama, threeawn.

    Phase 1.2
    1. Native, perennial, C4 shortgrass, 70-280 #ac, 5-20% (1 species minimum): blue grama, buffalograss, hairy grama, threeawn.

    Other: Minor - Phase 1.1
    1. Native forb, 85-170 #/ac, 5-10%: forbs vary from location to location .
    2. Shrub, 85-170 #/ac, 5-10%: leadplant, prairie sagewort, rose, smooth sumac.
    3. Native, perennial, C3, rhizomatous grass, 34-170 #/ac, 2-10%: western wheatgrass.

    Minor - Phase 1.2
    1. Forbs, 70-140 #/ac, 5-10%: forbs vary from location to location.

2. Grass-likes, 28-140 #/ac, 2-10%, (1 species minimum): threadleaf sedge, sedges.
3. Native, perennial, C4 tallgrass, 28-112 #/ac, 2-8%: big bluestem, sand bluestem, prairie sandreed, switchgrass, Indiangrass.
4. Native, perennial, C3, rhizomatous grass, 28-112 #/ac, 2-8%: western wheatgrass.
5. Shrubs, 70-140 #/ac, 5-10%: prairie sagewort, plains pricklypear, rose and other shrubs that vary from location to location.
6. Non-Native, C3 grass, 28-70 #ac, 2-5%: Kentucky bluegrass, cheatgrass, smooth brome.

Trace - Phase 1.1
1. Native trees, 0-34 #/ac, 0-2%: ponderosa pine, eastern redcedar, other trees.
2. Grass-likes, 0-34 #/ac, 0-2%: threadleaf sedge, other sedges.

Trace - Phase 1.2
1. Native trees, 0-28 #/ac, 0-2%: ponderosa pine, eastern redcedar, other trees.

Additional: The Reference Community (1.1) consists of nine F/S groups. These groups are in order of relative abundance native, perennial, C4 midgrass; native, perennial, C4 tallgrass; native, perennial C3 bunchgrass; native, perennial, C4 shortgrass; forbs; shrub; native, perennial, C3 rhizomatous grass; shrubs, grass-likes and trees.

The At-Risk Community (1.2) consists of ten F/S groups. These groups are, in order of relative abundance, native, perennial, C4 midgrass; native, perennial, C3 bunchgrass; native, perennial, C4 shortgrass; forb; grass-like; shrub = native, perennial, C4 tallgrass = native, perennial, C3 rhizomatous grass; non-native, C3 grass; native tree.

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Bunchgrasses have strong, healthy centers with few (less than 3 percent) dead centers. Shrubs may show some dead branches (less than 5 percent) as plants age.

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14. **Average percent litter cover (%) and depth (in):** Plant litter cover is evenly distributed throughout the site and is expected to be 50 to 70 percent and at a depth of approximately 0.25 inch (0.65 cm).

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** The representative value (RV) for annual production is 1,700 pounds per acre in a year with normal precipitation and temperatures. Low and High production years should yield 1,000 and 2,300 pounds per acre respectively.

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16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:** No non-native invasive species are present. Annual bromes (cheatgrass and Japanese/field), common mullein, and eastern redcedar are known invasives that have the potential to become dominant or co-dominant on the site.

Note: species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants.

17. **Perennial plant reproductive capability:** All perennial species exhibit high vigor relative to climatic conditions. Perennial grasses should have vigorous rhizomes or tillers; vegetative and reproductive structures are not stunted. All perennial species should be capable of reproducing annually.